APPENDIX C-1

METHODOLOGY FOR CALCULATING MEAN HERBICIDE CONCENTRATIONS

In Missouri, rivers and small reservoirs, and to a lesser extent, larger reservoirs, have seasonal variations in herbicide concentration. For example, combining all the herbicide data for rivers, small and medium sized reservoirs in the state, the average atrazine level for the month of February is 0.61 ug/l, and in June it is 3.49 ug/l, almost six times higher than in February. This seasonal variation must be considered when making estimates of annual averages. If the herbicide data available from a particular waterbody was taken mainly in February, using a simple average of all the data would probably result in a sizeable underestimate of the true average concentration while a data set composed mostly of June data would probably result in an overestimate.

The mean herbicide levels shown in Table C-1 were calculated in the following manner:

1. For each waterbody, a mean herbicide level was calculated for each month for which there was at least one data point.

2. For each waterbody, a grand mean for the waterbody was calculated by summing all the monthly means and dividing by the number of months for which data was available.

3. A determination was made of whether or not the database for that waterbody was "significantly seasonally biased.≅ This determination was done as follows: The year was divided into trimesters (January-April, May-August and September-December) and if 10% or less of the total data points or 50%or more of the data points fell in a single trimester, the data was judged to be "significantly seasonally biased.≅

4. If the database for that waterbody was not judged to be "significantly seasonally biased,≅ the grand mean became the value shown in Table C-1.

5. If the database for that waterbody was judged to be "significantly seasonally biased,≅ monthly means were adjusted based upon the relationship between monthly and annual herbicide means. One set of monthly adjustment factors was made for large reservoirs and a second set for all other surface waters. For example, for waterbodies other than large reservoirs, the mean atrazine value for the entire database for the month of February was 0.61 ug/l and when the grand mean was calculated from February and the other eleven monthly means, the grand mean was 1.52 ug/l. Thus if the database for a particular waterbody was composed entirely of February data, which had a mean of 1.05 ug/l, multiplying that amount by 1.52/.61, or 2.49, would result in an adjusted average atrazine value for that waterbody of (1.05)(2.49) = 2.61 ug/l, which would hopefully be a better estimate of the average atrazine level than 1.05 ug/l.

The table below lists these monthly adjustment factors. Starred (*) data in Table C-1 were adjusted in this manner.

Monthly Adjustment Factors for Herbicide Data in Missouri

Waterbody	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Large Reservoirs	1.12	1.12	1.65	1.65	.89	.89	.89	.89	.89	.89	.89	.89
Others	1.90	2.49	2.45	2.34	.53	.44	.56	.79	1.25	1.13	1.32	1.81

Example: Monroe City Route J Reservoir
Cyanazine data (ug/l)

All Data:	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
			0.26	0		0	0	9.00		0		0	
				0		0	9.90	0		19.65		0	
				0.64		0	5.25	0				11.50	
				1.26		4.13		5.39					
						2.48							
						1.93							
Mean	-	-	0.26	0.48	-	1.42	5.05	3.60	-	9.82	-	3.83	3.49

Is there significant seasonal bias? Yes. The second trimester has 13 of the 23 data points, this is greater than 50% of all the data. Thus, monthly adjustment factors for rivers and smaller reservoirs are used.

	Mar.	Apr.	June	July	August	Oct.	Dec.	Annual
Unadjusted Mean.	0.26	0.48	1.42	5.05	3.60	9.82	3.83	3.49
Adjustment Factor	2.45	2.34	0.44	0.56	0.79	1.13	1.81	
Adjusted Mean	0.64	1.12	0.62	2.83	2.84	11.10	6.93	**3.73**

Thus, the estimated mean cyanazine value, corrected for seasonal bias in sampling dates, for the Monroe City Route J reservoir for the entire period or record for cyanazine data is 3.73 ug/l.